

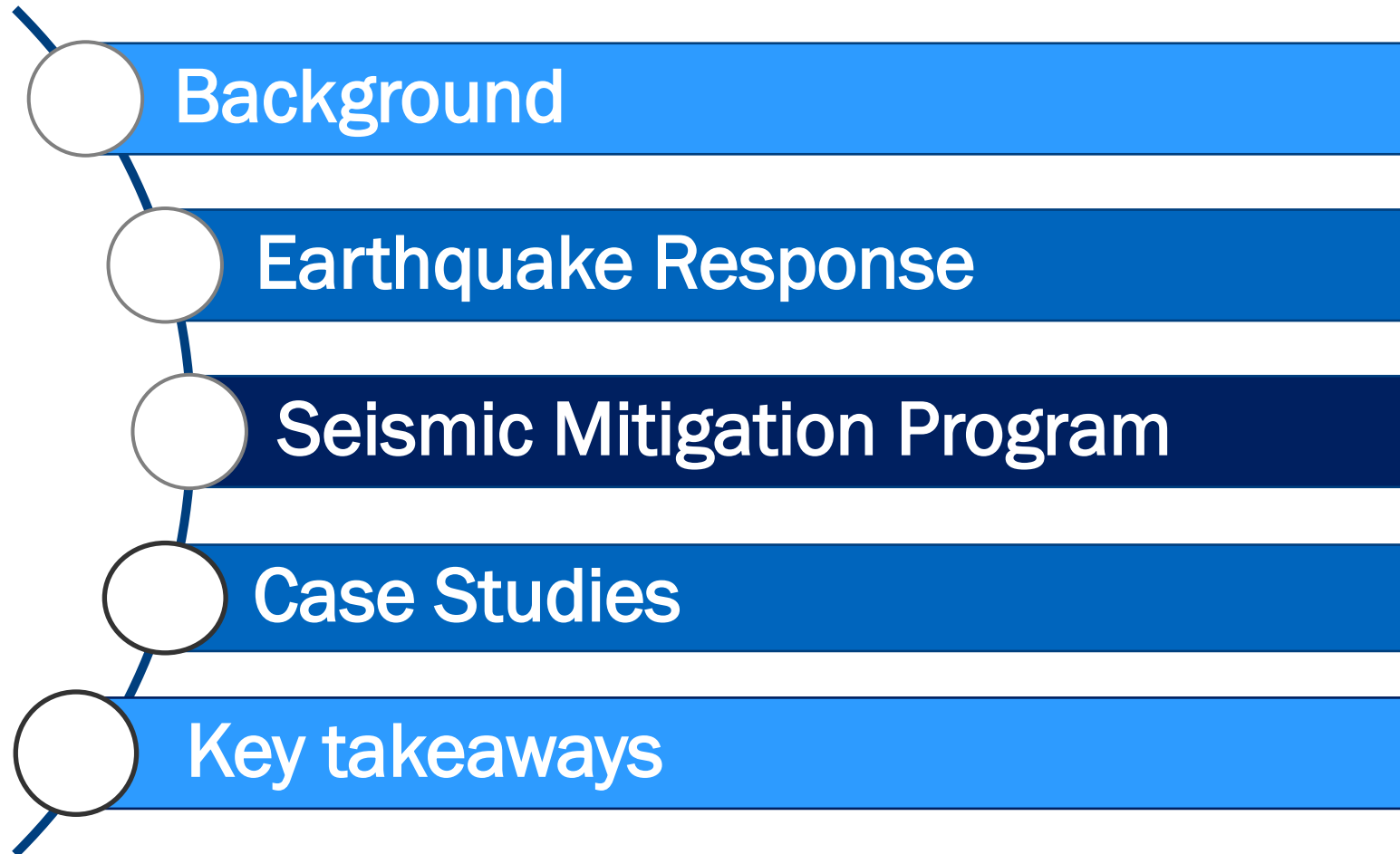


Earthquake Preparedness

BACWA Annual Meeting

May 15, 2026

Topics



The Hayward Fault

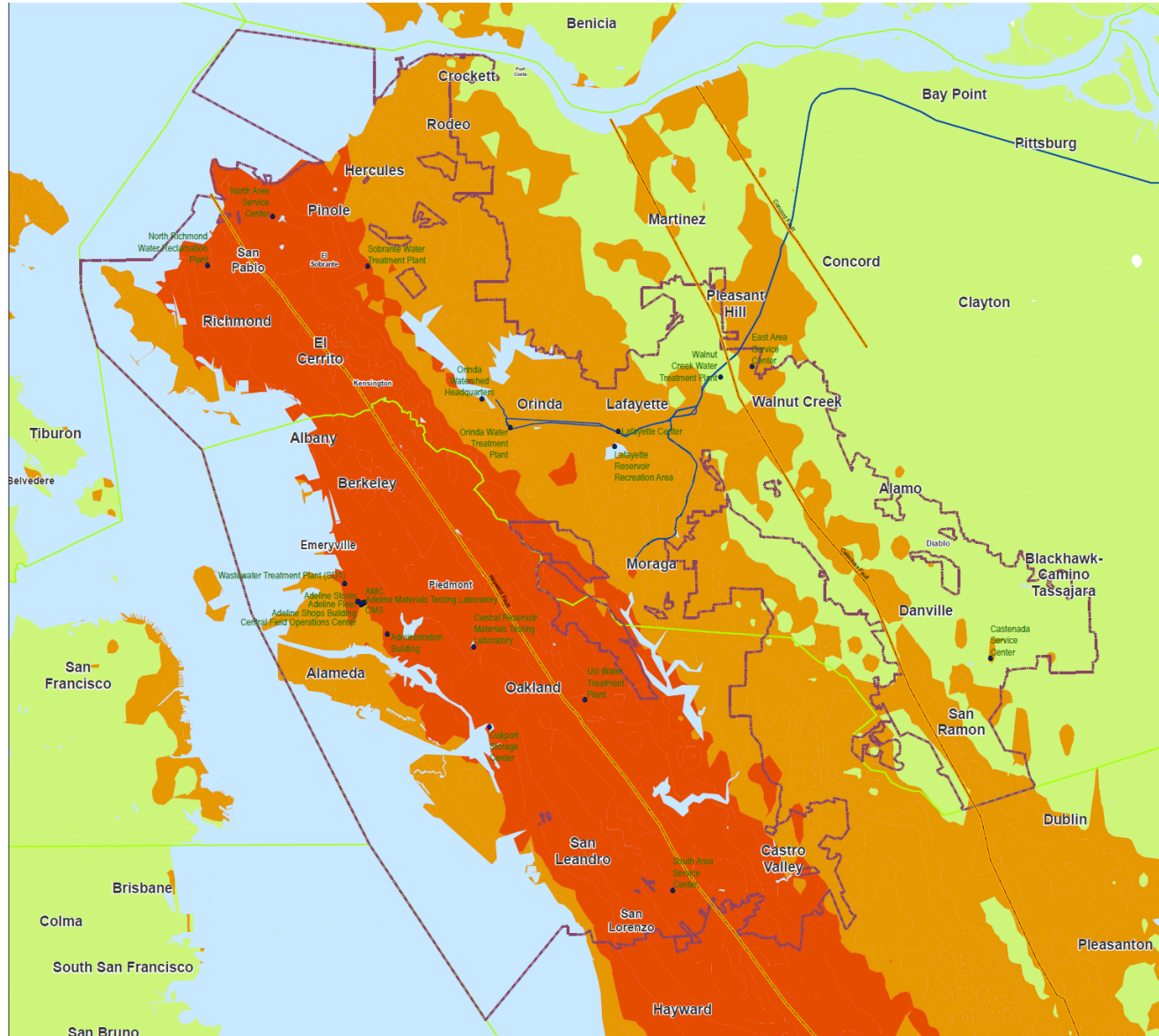
Every 140-150 years

Last time: 1868, 6.8 M

Current Population ~ 2.4 Million



Damage Scenario



USGS Hayward Fault 7.0 Scenario

- Staffed Facilities
- Faults
- Mokelumne Aqueducts
- ▭ EBMUD Service Area
- ▭ Counties

MMI (Modified Mercalli Intensity)

Potential Damage

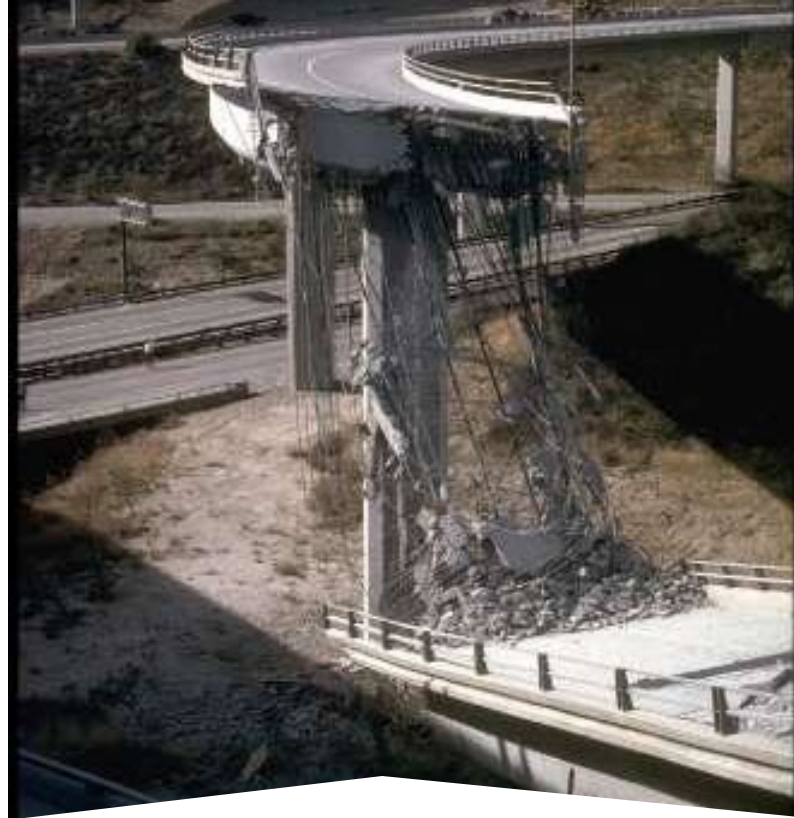
- ▭ None
- ▭ VI (Light)
- ▭ VII (Moderate)
- ▭ VIII (Moderate/Heavy)

Source: UC Berkeley, Seismology Lab



1989, Loma Prieta, CA

Source: USGS Earthquake Photo Collections



1994 Northridge, CA

Source: USGS Earthquake Photo Collections

“Psychologists describe a “normalization bias,” the human inability to see beyond ourselves, so that what we experience now or in our recent memory becomes our definition of what is possible. We think the common smaller events are all that we have to face, and that, because the biggest one isn’t in anyone’s memory, it isn’t real”

Jones, Dr. Lucy. *The Big Ones: How Natural Disasters Have Shaped Us (and What We Can Do About Them)* (p. 10). Knopf Doubleday Publishing Group.

Wastewater Collection System and Treatment

BY THE NUMBERS

88 Square Miles

740k Customers

1,600 Miles of Private Sewer Laterals

1,600 Miles of Pipe in the Collection System

37 Miles of Interceptor & Force Main Pipe

1 Wastewater Treatment Plant

3 Wet Weather Facilities

15 Pump Stations

14 Level Monitoring Stations

5 Overflow Structures

EBMUD



Initial Goals following major earthquake

- Life Safety
- Incident Stabilization
- Preservation of Property and Environment

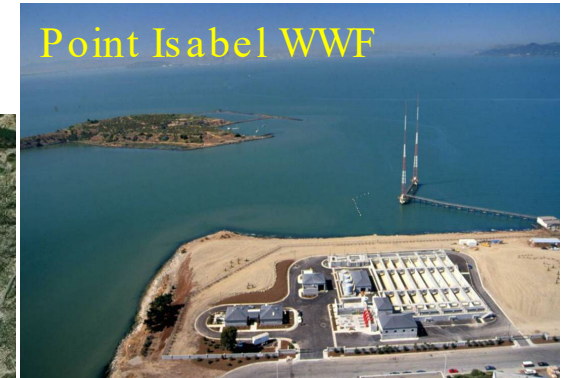
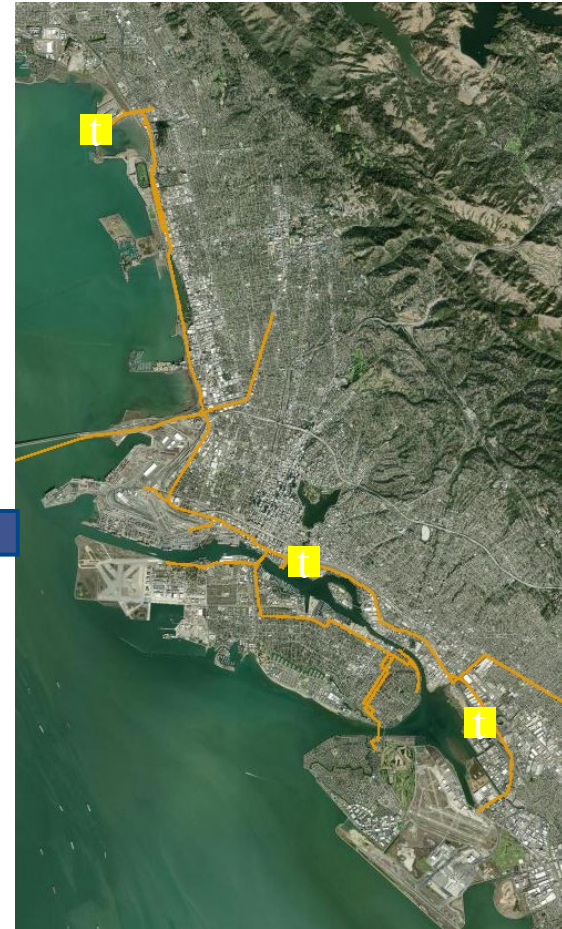
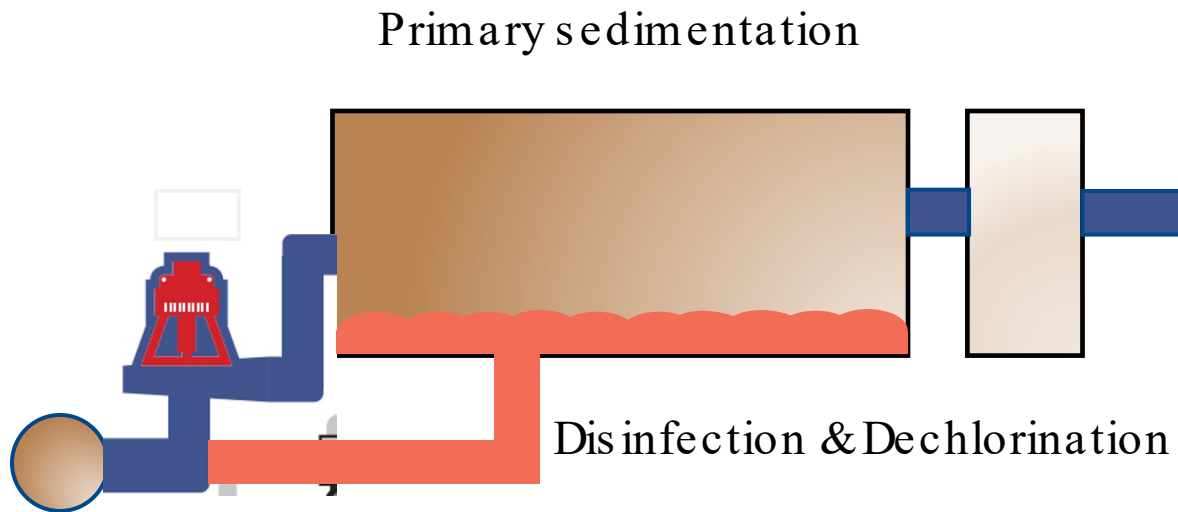


Key principles for Wastewater Treatment

- Utilize available storage
- Maximize available treatment
- Avoid SSO in the public streets and overflow structures
- Use wet weather facilities (partial treatment)



Wet Weather Facilities



Response Priorities

- Maintain personnel and public safety
- Damage Assessment
- Restore Power (Cogeneration Island mode/black start)
- Laboratory
- Interceptor and Pump stations
- Process restoration
 - IPS/Headworks
 - Primary
 - Disinfection/dichlorination
 - Secondary
 - Digestion/Dewatering
- Recycled Water Treatment Plants



Various Scenarios

- No significant damage
- Influent Pump Station inoperable
- Grit removal facilities inoperable
- Primary tanks/channels are damaged and inoperable
- Secondary reactor decks and/or O₂ system inoperable
- Damage to Pumpstation(s) and Interceptors
- Disinfection inoperable
- Dechlorination inoperable

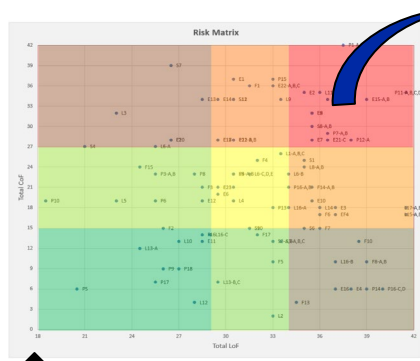


Seismic Evaluation Project

- Identify Structural Vulnerabilities
 - Standards and Guidelines
 - Site Investigations and evaluations
- Prioritize Facilities
 - Risk Assessment
- Develop Recommendations
 - Conceptual Design and Cost Estimate (Class V)
 - Project Proposals for CIP development



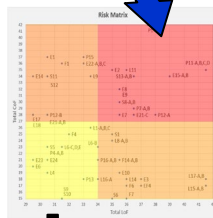
Project Approach



Preliminary Risk Assessment

Review All Facilities:

- Drawing Review
- Rapid Field Investigations



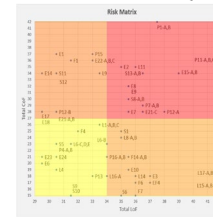
Detailed Field Investigation of 30± Facilities

Shortlist 15± Highest Risk Facilities

RANK	INCLUDE	LABEL	DESCRIPTION
1	1	P1A,B	PS
2	2	P11-A,B,C,D	Primary Influent Channel/Gallery
4	3	L11	Plant Effluent Channel
5	4	S13-A,B	Sludge Dewatering Bldg
6	5	E2	Elect Power Distribution System
7	6	P15	Primary Effluent Channel
8	7	E22-A,B,C	Power Generation Sta 2
9	8	L9	Secondary Effluent Channel
12	9	F1	Operations Center
13	10	E1	Elect Main Sub-Station H-1M-1
15	11	P12-A	Primary Sol. Tanks 1-10
16	12	P7-A,B	Vortex Grit Channel/Gallery
17	13	S11	Digesters S-1
18	14	S12	Digesters S-12
19	15	S7	Digester Control (Heating) Bldg
20	16	E21-C	Diesel Gas System for PGS1
24	17	S1	Digester Gallery
25	18	L1-A,B,C	Secondary Influent Channel/Gallery

Preliminary Evaluation of 15± Facilities

- Based on: ASCE 41, ACI 350
- Using Updated Criteria



Final Risk Assessment

RANK	INCLUDE	LABEL	DESCRIPTION	TCof
1	1	P1A,B	PS	42
2	2	P11-A,B,C,D	Primary Influent Channel/Gallery	35
4	3	L11	Plant Effluent Channel	33
5	4	S13-A,B	Sludge Dewatering Bldg	32
6	5	E2	Elect Power Distribution System	30
7	6	P15	Primary Effluent Channel	27
8	7	E22-A,B,C	Power Generation Sta 2	26
9	8	L9	Secondary Effluent Channel	24
12	9	F1	Operations Center	22

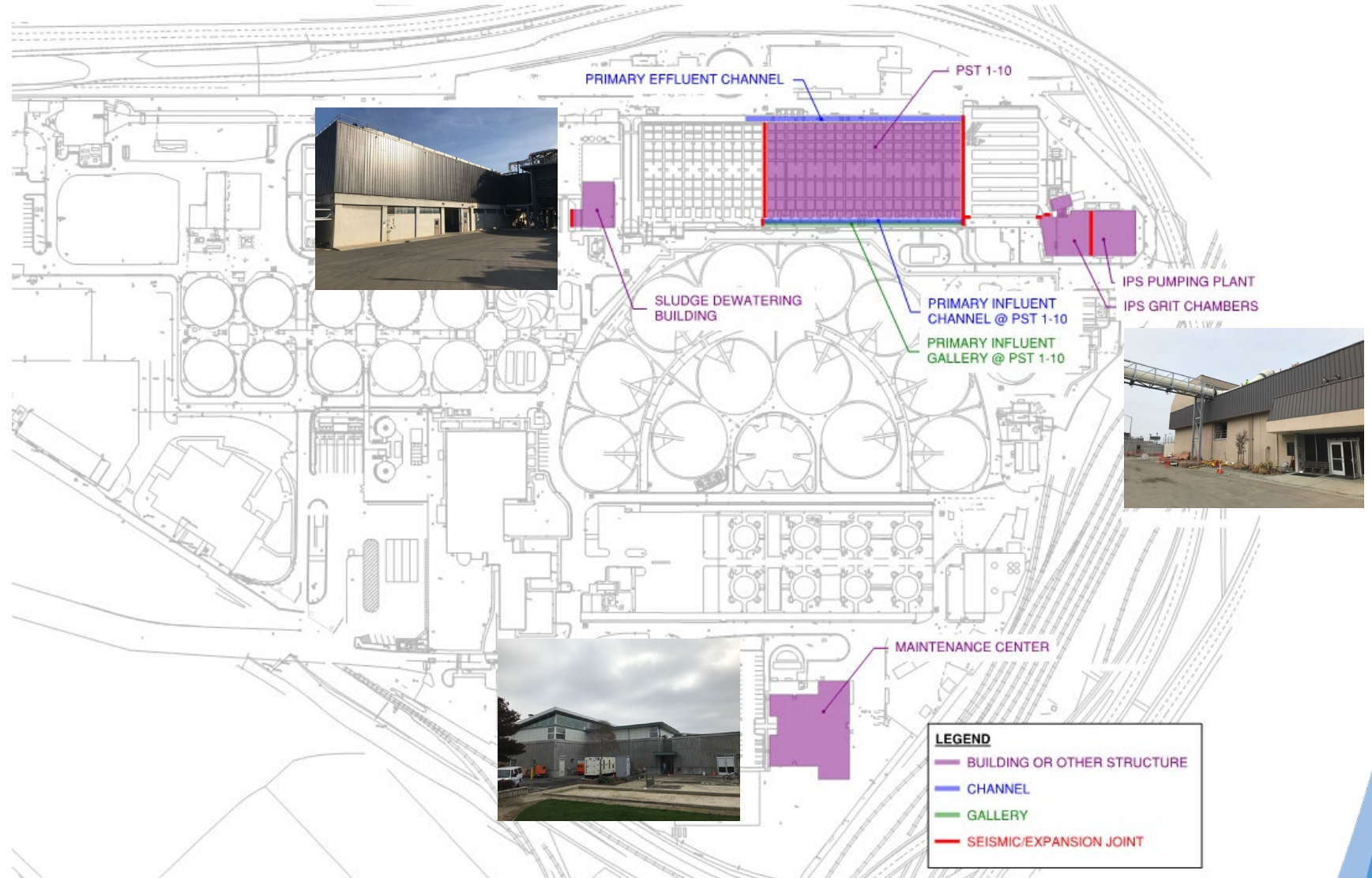
Conceptual Retrofit Design & Cost Estimate

Preliminary Risk Evaluation with the highest scores

Facility/Structure Name	TCoF x TLoF
IPS-Pumping Plant	1680
Primary Influent Channel @ PST 1-10	1663
IPS-Grit Chambers (Fine Screens Room)	1615
Primary Influent Gallery @ PST 1-10	1488
Primary Effluent Channel	1443
Plant Effluent Channel	1435
Sludge Dewatering Bldg	1360
Primary Sed Tanks 1-10	1344
Primary Influent Gallery @ PST 11-16	1278
Maintenance Center	1264
Power Generation Sta 1	1216

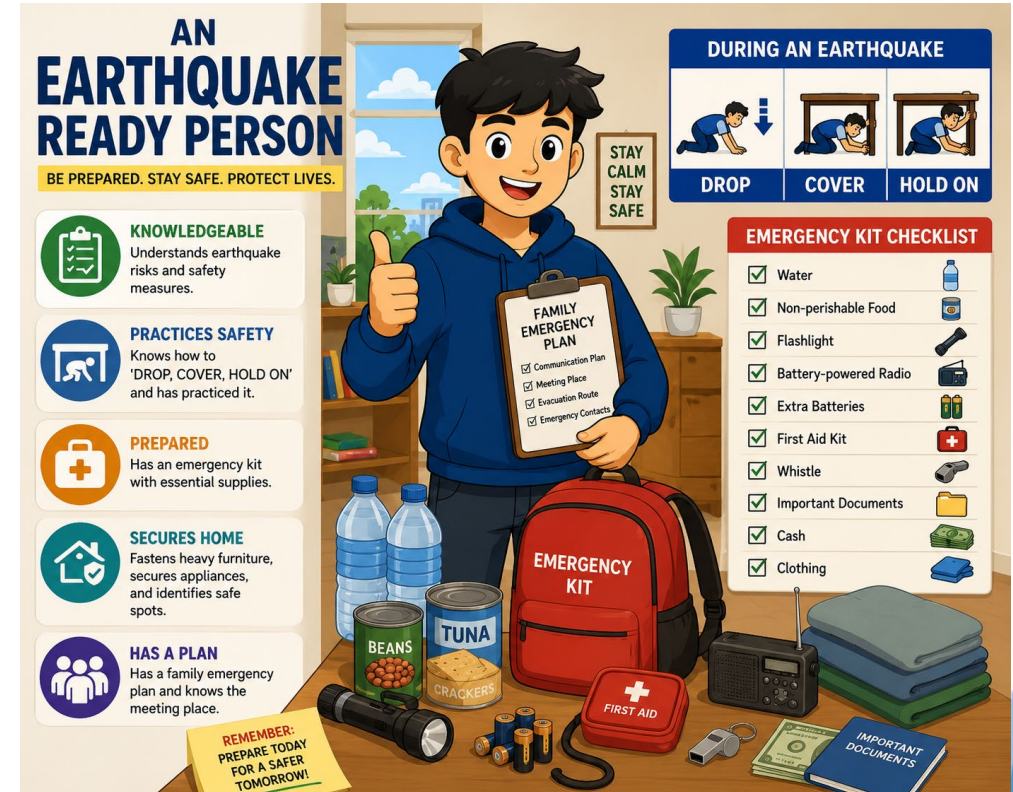
TCoF: Total Cost of Failure, TLoF: total likelihood of failure

High Risk Facilities



Are you earthquake-ready?

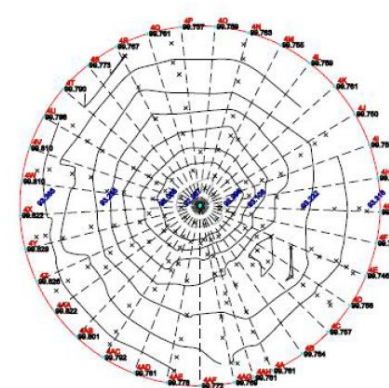
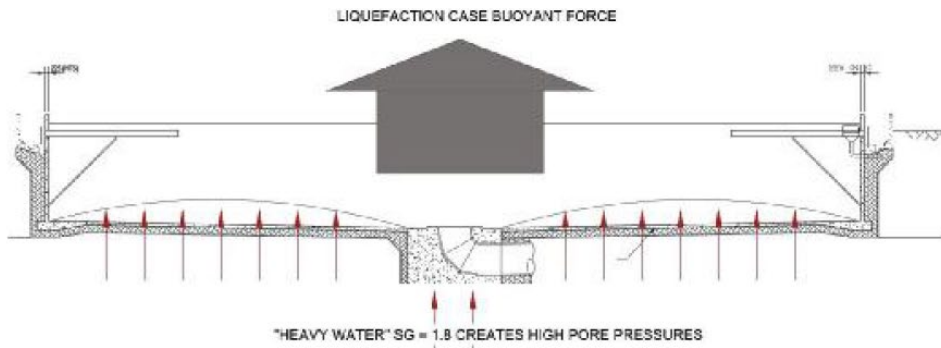
- Store enough water to last for 3 to 7 days
- Emergency food for the family
- Emergency/ disaster supplies
- Sanitation Kits
- Don't forget your pets !!
- For more information:
 - www.ready.gov/earthquakes
 - www.redcross.org/prepare
- You will be needed at work during and after a disaster emergency
 - Do you have a personal disaster kit ready to report to work
- Do you have an emergency communication plan ready?



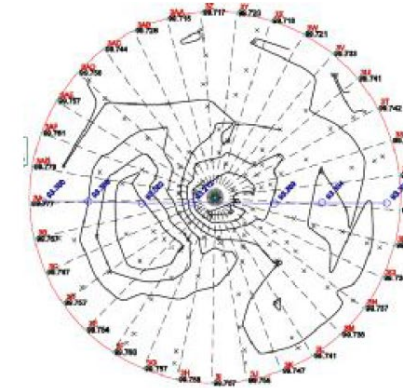
Case Studies

- Christchurch, New Zealand, 6.3 M, Feb 2011
- East Japan Earthquake, 9.0 M, March 2011
- Kaikoura Earthquake, 7.8 M, November 2016

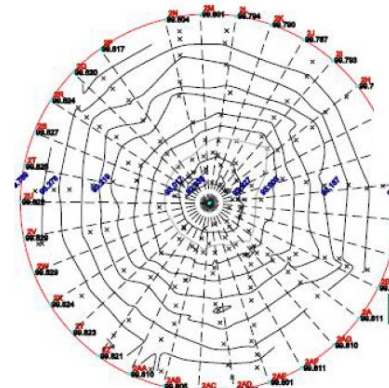
Christchurch



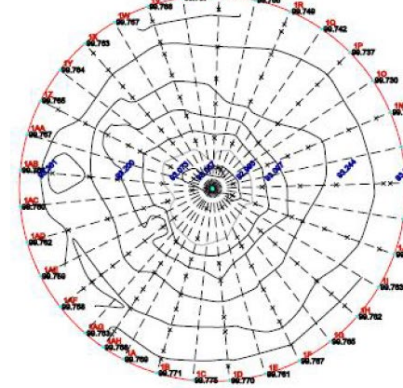
Clarifier 4



Clarifier 3



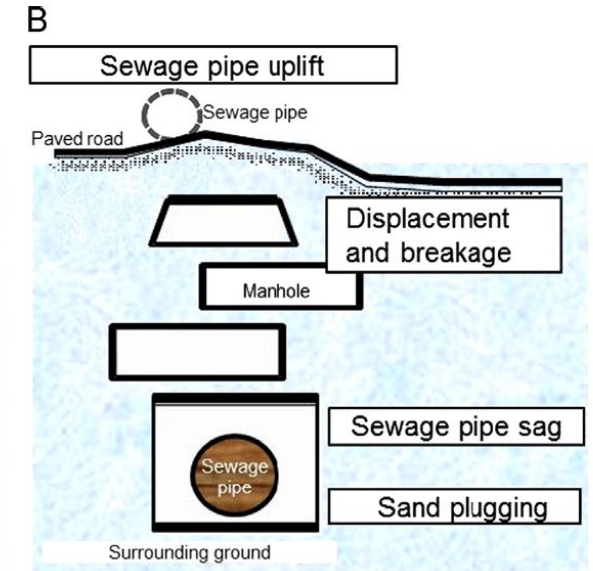
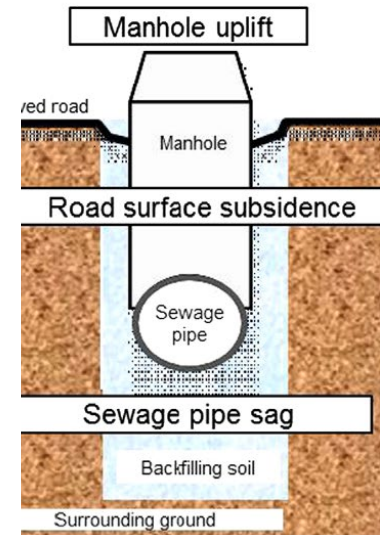
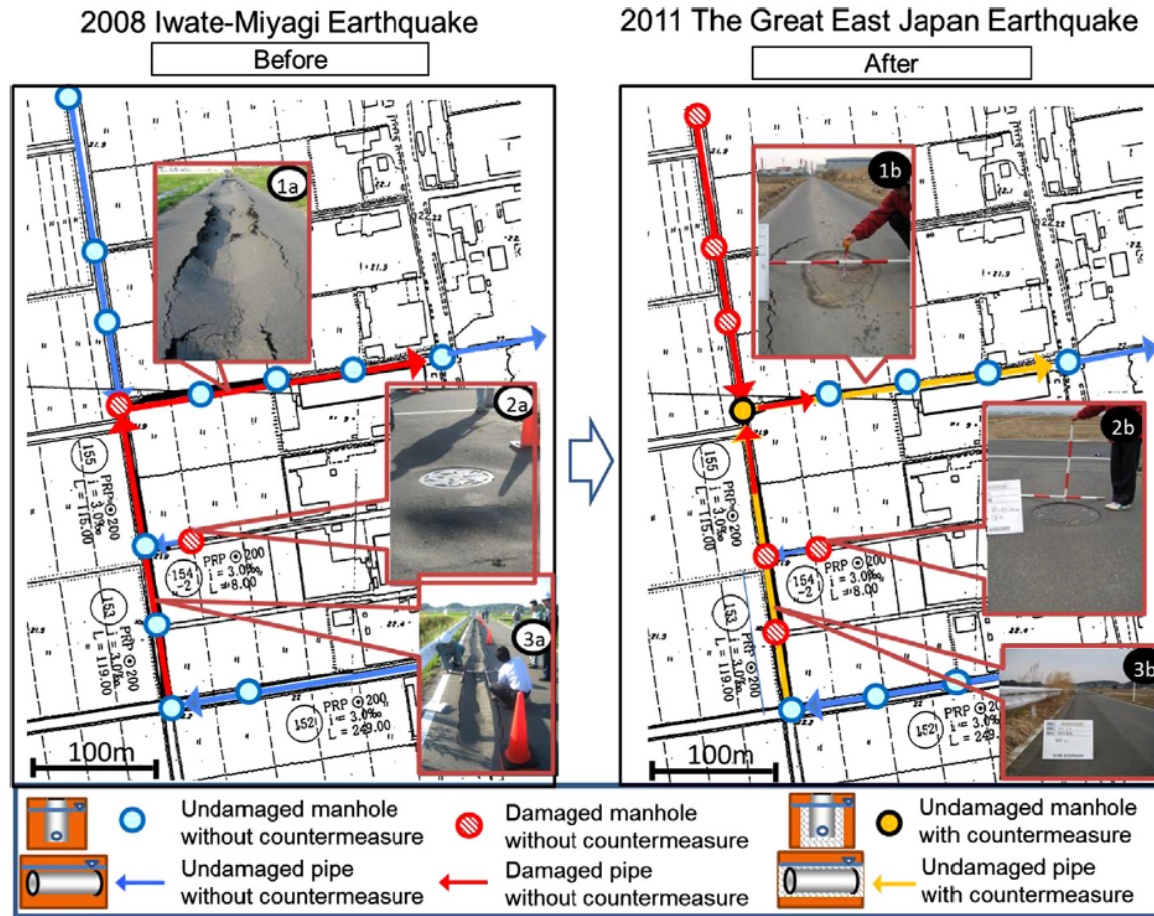
Clarifier 2



Clarifier 1

Channels

Japan Earthquake (liquefaction)



Kaikoura Earthquake

(a)

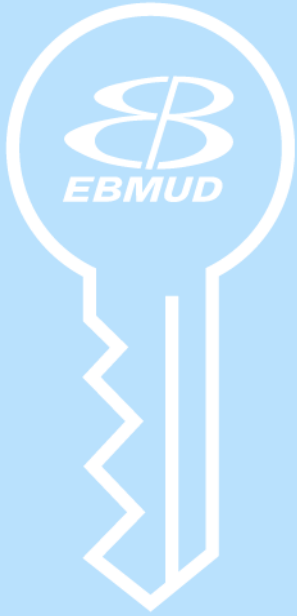


Figure 6. Ferrocement tanks at Ward, installation has collapsed (Photo: Marlborough District Council).

(b)



Figure 7. East side of the Needles Creek Bridge north of Ward on the SH1, viewed from the north. Original freshwater pipelines have failed and been replaced temporarily with ductile pipes (in black) (Photo: X. Bellagamba).



Call for Action

- Big one will happen, the question is when?
- Develop contingency plans for various scenarios
- Seismic Evaluations for critical structures and processes
- CIP project plans for retrofit
- Earthquake Preparedness for staff



Questions?



Operation Control Center and Secondary Clarifier